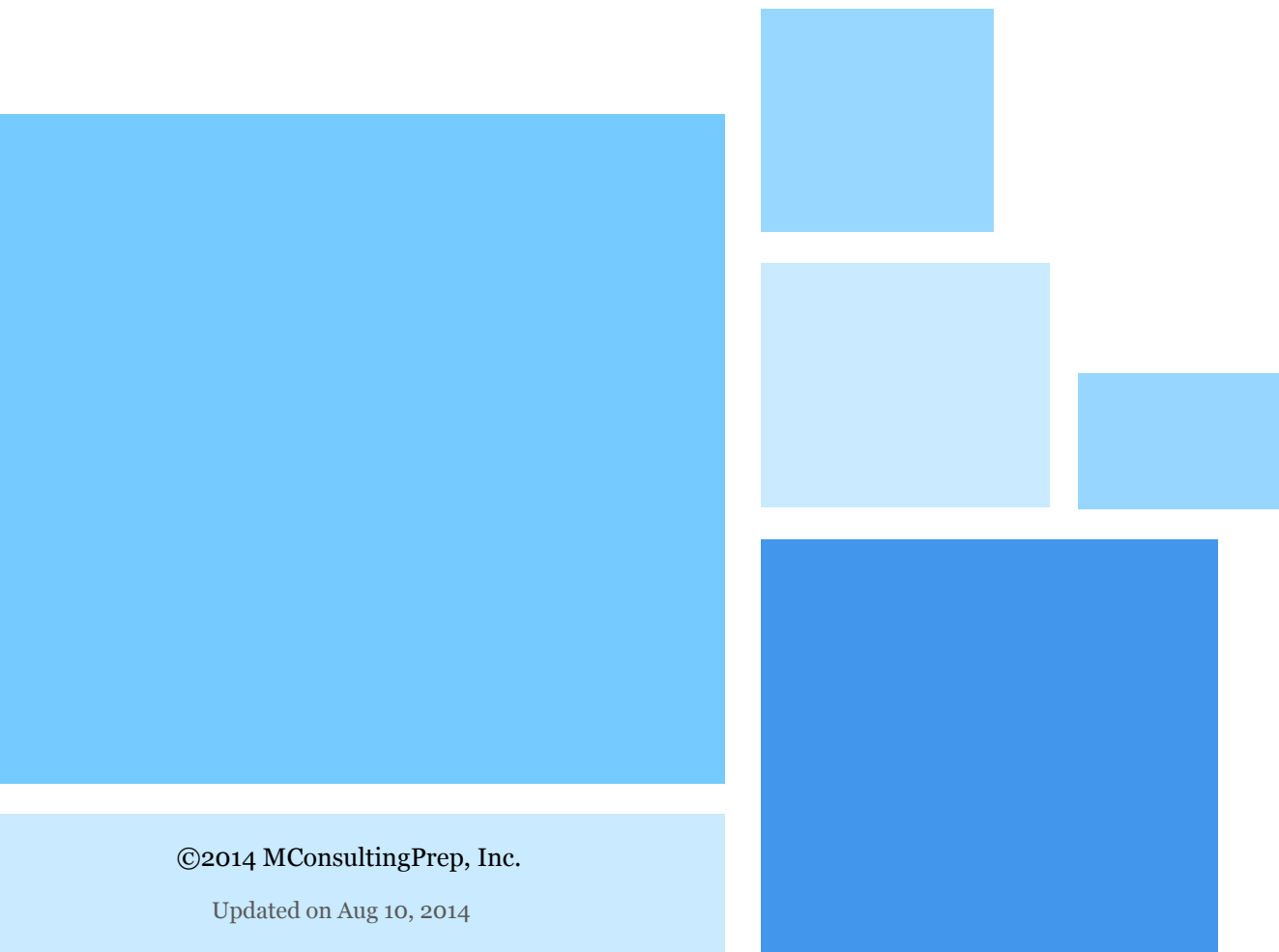


# McKinsey Problem Solving Test Practice Test - TOYO



# McKinsey Problem Solving Test

## Practice Test Overview and Instructions

This practice test has been developed to provide a sample of the actual McKinsey Problem Solving Test used for selection purposes. This test assesses your ability to solve business problems using deductive, inductive, and quantitative reasoning. This practice case contains a total of **9 questions and should be completed in 20 minutes**. The actual test contains 26 questions and you will be given 60 minutes to answer as many questions as possible.

You will be presented with a scenarios based on an actual McKinsey client cases. Information related to each scenario will be shown in text, table, and exhibits. This information is presented in shaded areas and is distributed in sections throughout the scenario. The questions ask you to find the most appropriate answer to the problem as described using only the information presented. You should select on and only one answer to any question.

While completing this practice case, **do not use any electronic devices** (e.g., calculator, computer) when performing calculations to answer the questions. Electronic devices will not be permitted to be used during the actual test administration. Also during the actual test administration, you may use all blank space in the test booklet as scratch paper to assist you in performing any calculations and recording any notes. No scratch paper will be allowed. Booklets will be destroyed after you complete the test and will not be used in any way to determine your test scores. Your final test score will be based on the number of questions you answer correctly.

This practice scenario begins on the next page of this booklet. Only consider information contained within the scenario when determining your answer. Considering all information presented within the scenario is critical to answering questions correctly.

After you have completed the test, score your answer using the answer key located at the end of this booklet. Add the number of correct answers to determine your final total score.

Following your completion of this practice case, please take a minute and tell us your thought: <https://docs.google.com/forms/d/1OQo6VSudJv-NgeU8I6oo4fHIrxjzEmLNugK5XaP5UBA/viewform>

## TOYO Piano

TOYO Piano (TOYO) is a Japan-based company offering a full range of piano-related products and services. Since its establishment in 1934, the company has vastly expanded its business and presence. Nowadays, TOYO has stores and services centers in over 20 different countries in all 5 continents. TOYO has a reputation for superior customer and after-sales services.

TOYO operates on three major business lines:

- **New Piano Retailer:** TOYO sells brand new pianos mainly of Japanese brands, with which it has great relationships with. This business line concentrates on developed countries like Japan, Korea, the United States, and Europe.
- **Used Piano Refurbishing:** TOYO buys back old pianos, typically 50 years old, from developed countries, refurbishes them, and sells to developing markets like South East Asian countries. TOYO possesses a large distribution network and the best-in-class refurbishment technology, which enable it to stay competitive with this business line.
- **Piano Services:** TOYO also provides Piano enhancement and maintenance services like painting, fixing, tuning, etc. to individuals and organizations. Despite having a premium brand image, TOYO faces increasing competition from various small local services providers.

The recent worldwide economic downturn has been causing TOYO major damages as TOYO global revenue has vastly decreased for the last 3 years. The TOYO global Managing Director thinks that the problem does not lie in the economic recession but instead in TOYO's business model. He states that the giant-size model is no longer suitable with the highly dynamic business environment nowadays as it is slow in recognizing pitfalls and adapting changes. The recent recession is just a triggering event to the long-existing problem within TOYO.

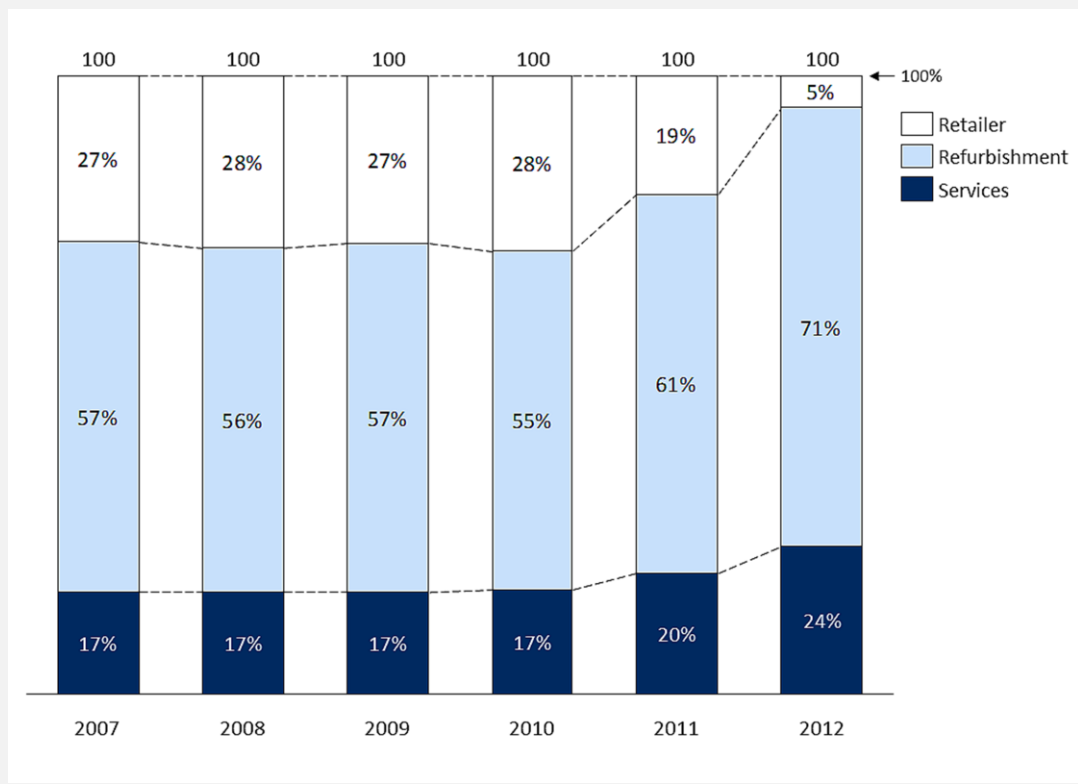
Table 1 shows TOYO Piano Worldwide Revenue in recent years.

Table 1						
TOYO Piano Worldwide Revenue (in \$US Millions)						
	2007	2008	2009	2010	2011	2012
Revenue	2,549	2,734	2,812	2,789	2,395	1,923

Exhibit 1 shows breakdown of TOYO Worldwide revenue into its business lines. The data for business lines is presented as a percentage of TOYO's total revenue in each specific year.

**Exhibit 1**

**TOYO Worldwide Revenue Breakdown by Business Lines**



1. Which of the following statements best describes the concern of the TOYO managing director?
  - A) The director is concerned that TOYO's global revenue has been decreasing and its big size does not allow TOYO to survive through the recession
  - B) The director is concerned that TOYO's business model is not suitable for the current recession
  - C) The director is concerned that the fast-changing business environment does not favor big and complex companies like TOYO
  - D) The director is concerned that recessions will trigger problems existing within TOYO

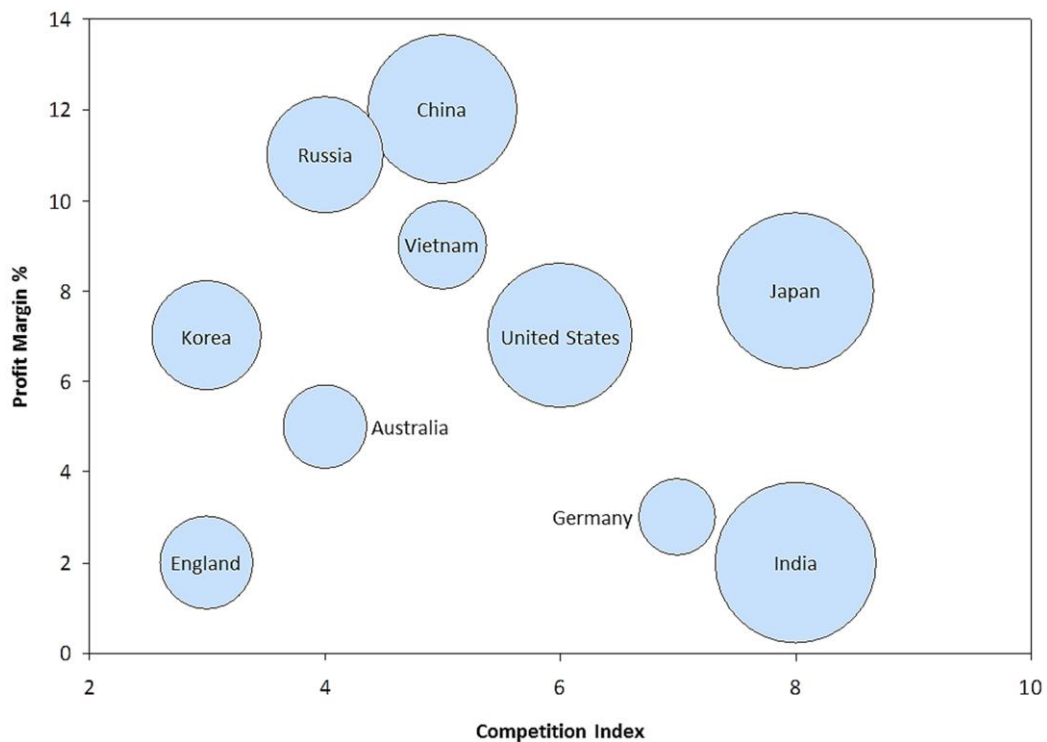
2. Based on the data presented in Table 1 and Exhibit 1, which of the following statements is true?
  - A) Revenue from Refurbishment has stayed relatively flat for the last 6 years
  - B) Revenue from Services has increased since 2010
  - C) The sales growth rate has been increasing in every year between 2007 and 2009
  - D) The sales reduction rate has been increasing in every year between 2009 and 2012
  
3. Which of the following statements, if true, best explains why the Retail line sale is negatively impacted the most by the recession?
  - A) TOYO has the best-in-class refurbishment technology, which enables it to maintain the competitive quality throughout the recession
  - B) Piano vendors cut their price charged to retailers in response to the recession
  - C) People tend to cut spending during a recession by switching to lower-cost instruments like guitars, keyboards, etc.
  - D) People tend to cut spending during a recession by switching to lower-cost piano

In an effort to simplify the company's geographical structure, the team gathers data on various countries that TOYO has presence in to find out which market is dragging TOYO's overall profitability down. Exhibit 2 maps 10 countries under consideration onto a grid which illustrates TOYO's current profit margin, competition index, and TOYO's current revenue in each country in 2012. Competition index is a measurement of how intensive competition in a market is with a higher index indicating more intensive competition. TOYO's current revenue is represented by bubbles with bigger sizes indicating larger revenue.

### Exhibit 2

#### 2012 TOYO Piano's Profit Margin, Competition Index, and Sales Size in the 10 Markets

#### Under Consideration



4. Which of the following is the accurate rank of profit contribution of particular countries from low to high based on the data in Exhibit 2?
- A) England, India, Australia, Japan, United States
  - B) Vietnam, Japan, United States, Russia, China
  - C) Germany, Australia, Vietnam, Japan, China
  - D) Vietnam, Korea, Australia, India, England
5. Which of the following statements, if true, would NOT help support an argument AGAINST exiting the India market?
- A) Many smaller competitors in India will not be able to survive through this recession
  - B) The detailed breakdown of India shows the major profitability issues lie in only the retails business line
  - C) Despite not being profitable, India is the major source of used piano for refurbished piano sold to other countries
  - D) A number of smaller competitors would be able to quickly adapt to changes in this business environment nowadays, specifically this recession

Hypothesizing that people tend to choose lower-cost pianos during the recession time, the team decides to study the impact on refurbishment profitability. The following facts have been gathered and confirmed:

- People, including TOYO customers, do choose cheaper refurbished piano during recessions
- Transportation cost is the same for all refurbished piano and is relatively not affected by the recession
- The refurbishment cost varies by piano, but generally is proportionate with the purchasing cost of each piano
- To keep the premium brand image, TOYO has been keeping the selling price of each particular piano at the same level with before the recession
- The selling price varies by piano, but generally is proportionate with the purchasing cost of each piano

6. Which of the following is a valid conclusion based on the above facts?
- A) TOYO total profit of the Refurbishment business line has been decreasing during the recession
  - B) TOYO average total cost of each piano sold has increased during the recession
  - C) TOYO average profit margin of pianos sold has decreased during the recession
  - D) TOYO is selling less pianos during the recession



In an attempt to cut cost for after-sales services, the team gathers information regarding various support methods:

- Whenever there is a support request from a customer, TOYO gives the customer a diagnostic phone call. Sometimes the issue is resolved right away.
- Most of the time, a technician is sent to the customer's home for physical support. If the technician is unable to resolve the issue, a more senior sound engineer is sent.
- In some occasions, a senior sound engineer is sent directly after the diagnostic call depending on the value of the piano and the complexity of the problem
- TOYO receives a total of approximately 1 million support requests worldwide every year

Table 2 represents cost and share of each support method.

<b>Table 2</b> <b>After-sales Services Methods' Cost and Frequency in 2012</b>			
<b>Support Method</b>	<b>Explanation</b>	<b>Cost per try (\$US)</b>	<b>Percent of all requests using this method (percent)</b>
<b>Call diagnostic</b>	Every time a support request is received	15	$c$ (100)
<b>Technician</b>	A junior specialist is sent to the customer's home	70	$t$ (60)
<b>Sound Engineer</b>	A more senior specialist is sent to the customer's home	100	$s$ (30)

7. Which of the following figures is closest to the daily worldwide cost of after-sales support for TOYO Piano?
- A) \$87 million
  - B) \$15 million
  - C) \$87 thousand
  - D) \$240 thousand
8. Which of the following equations best approximate the percentage,  $p$ , of all support requests successfully resolved through diagnostic calls?
- A)  $p = c$
  - B)  $p = c - t - s$
  - C)  $p > 100 - t - s$
  - D)  $p < 100 - t - s$

The team decides to investigate the potential impact of a call optimization program on TOYO Piano. The program involves setting up a centralized call center in India, which will perform all support calls globally. The program also includes a capability building for the newly-organized team to increase the rate of success of the diagnostic call. However, generally if a request needs to be escalated to the Sound Engineering level ultimately, it cannot be resolved in the diagnostic call even with the capability building program. The program will cost a total of \$10 million.

9. What is the maximum level of requests involving technicians TOYO needs to stay at in order to make the call optimization program financially beneficial after 2 years?
- A) 45% of all requests
  - B) 50% of all requests
  - C) 52% of all requests
  - D) 60% of all requests

\*\*\*

## CONGRATULATION!

Researches show that each practice PST case done increases on average **0.5 / 26 point** in the real Problem Solving Test.

**72% people downloaded this TOYO case PDF went on to get more practice!**

Get yours here:

<http://www.mconsultingprep.com/problem-solving-test/Free-practice-McKinsey-PST>

## Quick Answer Key

**Notice:** McKinsey PST is a time-pressured test! So if you did spend more than **20 minutes** allowed for this practice case, **deduct** yourselves a few points from your score!

Do the same for calculators!

1. C
2. D
3. D
4. C
5. D
6. C
7. D
8. C
9. C

How many did you get (in exact 20 minutes)?

Sources say that approximately a score of 70% is required to pass the McKinsey Problem Solving Test. Translating into this TOYO case, it would be **6.3 / 9** points.

If you are to take the Problem Solving Test tomorrow, are you ready for it? If not, you are not alone:

**72% people tried this TOYO case went on to get more practice!**

Get yours here:

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## Detail Answer Key

In this answer key, we will show the question classification and detail explanation of how and why choices are and are incorrect. We will be using concepts and terminologies explained in details in <http://www.mconsultingprep.com/problem-solving-test/how-to-prepare>

### 1. Client Interpretation – C

In simple language, the Director's opinion can be summarized as follow:

**The business model (big-size) is not suitable with fast-moving environment anymore.** The recession is not a big matter; it's just a triggering event to help us see the more at-root problem.

Choice A, B, and D do incorrectly reflect the Director's concern because of the following underlined words and phrases.

- A) *The director is concerned that TOYO's global revenue has been decreasing and the big size does not allow TOYO to survive through the recession*  
The director is not concerned with the revenue problem. He worries more about **the business model**. Also he didn't make any assertion on whether TOYO will survive through the recession or not.

Our survey shows that 6% respondents choose A

- B) *The director is concerned that TOYO's business model is not suitable for the current recession*

The director thinks that the business model is not suitable for **the nowadays fast-moving business environment**, not for the current recession. The recession is just a triggering event.

Our survey shows that 33% respondents choose B

- C) *The director is concerned that the fast-changing business environment does not favor big and complex companies like TOYO*

Our survey shows that 57% respondents choose C

- D) *The director is concerned that recessions will trigger problems existing within TOYO*

The director is concerned of the root-cause problem (**big size model**), not the fact that recession will trigger more problems existing.

Our survey shows that 4% respondents choose D

## 2. Reading Facts– D

Choice A, B, and C are incorrect because of the following reasons.

- A) *Revenue from Refurbishment has stayed relatively flat for the last 6 years*  
Wrong Calculation: Revenue from Refurbishment has been declining since 2010 (from \$1,523 million in 2010 down to \$1,362 million in 2012).

Our survey shows that 12% respondents choose A

- B) *Revenue from Services has increased since 2010*  
Mis-read Facts: You would pick this if you are unaware that the Exhibit 1 shows business lines' size as the **percentage of TOYO sales**. The exhibit does not present size as absolute value. So even though Services' share has increased since 2010, its absolute value has been going down, making this choice incorrect.

Our survey shows that 18% respondents choose B

- C) *The sales growth rate has been increasing in every year between 2007 and 2009*  
Wrong Calculation: Sales revenue growth rate has not been increasing (7% in 2008 and 3% in 2009).

Our survey shows that 6% respondents choose C

- D) *The sales reduction rate has been increasing in every year between 2009 and 2012*  
 This is correct. Sales reduction rate in consecutive years was 0.8% (2009-2010), 14% (2010-2011), and 20% (2011-2012).

Our survey shows that 64% respondents choose D

### 3. Root-cause Problem – D

Choice A, B, and C are incorrect because of the following reasons.

- A) *TOYO has the best-in-class refurbishment technology, which enables it to maintain the competitive quality throughout the recession*

Wrong subject: The question specifically asks about the Retail business line. The statement on A is relevant only when there is a clear linkage between the Retail and Refurbish lines which is not the case here.

Our survey shows that 4% respondents choose A

- B) *Piano vendors cut their price charged to retailers in response to the recession*

Wrong subject: This statement talks about the **cost** side of the Retail business line when the question asked is about the **revenue** side.

Wrong trend: Even if the question asks about profit (to make the subject become relevant), this statement is still wrong. Because if vendors lower their price, **positive** impact is created!

Our survey shows that 8% respondents choose B

- C) *People tend to cut spending during a recession by switching to lower-cost instruments like guitars, keyboards, etc.*

Wrong subject: if people switch to lower-cost instruments, all business lines will be negatively impacted, not just only the Retail side.

Our survey shows that 18% respondents choose C

- D) *People tend to cut spending during a recession by switching to lower-cost pianos*

This is correct in both subject and trend. By switching to lower-cost pianos, people will tend to buy refurbished pianos instead of brand new pianos. This statement logically leads to the facts that the Retail line is negatively impacted the most.

Our survey shows that 70% respondents choose D

#### 4. Reading Facts – C

Choice A, B, and D are incorrect because of the following reasons.

A) *England, India, Australia, Japan, United States*

Japan's profit is higher than the United States'. Even if this is unclear from the chart, test takers can logically infer to this by seeing choice B. If Japan's profit is less than that of the United States, A and B are both correct. This is impossible.

Our survey shows that 12% respondents choose A

B) *Vietnam, Japan, United States, Russia, China*

Japan's profit is higher than the United States'. Even if this is unclear from the chart, test takers can logically infer to this by seeing choice A. If Japan's profit is less than that of the United States, A and B are both correct. This is impossible.

Our survey shows that 16% respondents choose B

C) *Germany, Australia, Vietnam, Japan, China*

Our survey shows that 58% respondents choose C

D) *Vietnam, Korea, Australia, India, England*

This list is reversed in order. In fact, the question asks for a ranking from **low to high**.

Our survey shows that 14% respondents choose D



### 5. Root-cause Reason (Twist version) – D

Choice A, B, and C, if true, ARE arguments against exiting the India market because of the following reasons.

- A) *Many smaller competitors in India will not be able to survive through this recession*

If this is true, the competition in India will become less intensive, meaning a better outlook for the country.

Our survey shows that 12% respondents choose A

- B) *Detailed breakdown of India shows the major profitability issues lie in only the retails business line*

If this is true, the profitability problem in India will become easy to isolate and fix. TOYO can just close the Retail business line instead of completely exiting the country.

Our survey shows that 15% respondents choose B

- C) *Despite not being profitable, India is the major source of used piano for refurbished piano sold to other countries*

If this is true, exiting India will put a negative impact on the Refurbishment business line of TOYO overall. As said in the case introduction, “a large distribution network” is one of the two critical factors in order for the Refurbishment line to prosper.

Our survey shows that 28% respondents choose C

- D) *A number of smaller competitors would be able to quickly adapt to changes in this business environment nowadays, specifically this recession*

This is tricky in the sense that choice D, if true, does not necessarily SUPPORT staying India. But it clearly does NOT support AGAINST exiting. A number of smaller competitors will be able to survive, making the competition landscape still relatively intensive.

Our survey shows that 45% respondents choose D

## 6. Fact-based Conclusion – C

*Profit margin of each piano sold has decreased during the recession*

C is correct; it can be logically concluded from the provided facts. To have the explanation be as visual as possible, let's say the Profit margin TOYO gets for each refurbished piano sold is PM%. Pri is the average selling Price of all piano sold; T is transportation cost per piano; RC is Refurbishment Cost per piano; PC is Purchase Cost per piano.

$$\begin{aligned}
 \text{PM\%} &= \text{Total Profit} / \text{Average Selling Price} \\
 &= (\text{Pri} - \text{T} - \text{RC} - \text{PC}) / \text{Pri} \\
 &= (\text{Pri} / \text{Pri}) - (\text{T} / \text{Pri}) - (\text{RC} / \text{Pri}) - (\text{PC} / \text{Pri}) \\
 &= 1 - (\text{T} / \text{Pri}) - (\text{RC} / \text{Pri}) - (\text{PC} / \text{Pri})
 \end{aligned}$$

According to the facts, (RC / Pri) and (PC / Pri) are constant. We can conclude that average Pri decreases (even though the price of each particular piano stays the same, people tend to choose cheaper pianos during the recession, making the overall average Price go down). We also know that T is constant on per piano basis.

So we can conclude that (T / Pri) increases, resulting in a decreasing PM%.

**Notice:** If you are good at math, there's no need to go through the long process as presented above. It is just for the presentation purpose of showing you how conclusion C is logically correct.

Our survey shows that only 28% respondents choose C

Also, you may use the eliminate strategy to reject choices A, B, and D as follows.

A) *Total profit of the Refurbishment business line has been decreasing during the recession*

Un-proven: There is no fact on the number of pianos sold. Even though profit margin may go down, total profit may go up if there are more pianos sold.

Our survey shows that 14% respondents choose A

## TOYO Piano

- B) *Average total cost of each piano sold has increased during the recession*

Proven false: According to facts provided, Purchase Cost and Refurbishment Cost will decrease as Price decreases during the recession. The Transportation cost stays constant. So the Total cost will decrease.

Our survey shows that 14% respondents choose B

- D) *TOYO is selling less pianos during the recession*

Un-proven: It is not mentioned anywhere in the case about the number of pianos sold during the recession. This is an example of a “fits-well” conclusion. It seems to fit to the fact that Total revenue is going down during the recession. However, when the price decreases, the number of pianos sold can stay constant or slightly increase and still have the overall revenue going down.

Some candidates emailed me on this choice D. It's hard for them to imagine D is “un-proven” because it's so intuitive to be true. They argue that if TOYO keep price of each piano the same despite the recession, competitors may have more competitive prices, which lead to lower #unit sold for TOYO.

My argument is that: **we don't that for sure!** What if TOYO provide better services to accommodate that? What if competitors also keep their prices high? What if customers are attracted to premium prices? Etc.

This is the biggest difference between a **hypothesis** (for the “Root-cause” type questions) and a **conclusion** (for this type of question). A hypothesis just need to “fit-well” with data but a conclusion must be concretely and logically true based on facts.

Our survey shows that 44% respondents choose D

7. **Reading Facts– D**

*\$240 thousand*

This table shows calculation for total cost of TOYO in a **YEAR**:

	<b>Cost per try</b>	<b># of requests</b>	<b>Total cost</b>
<b>Call instruction</b>	\$15	1,000,000	\$15,000,000
<b>Technician</b>	\$70	600,000	\$42,000,000
<b>Sound Engineer</b>	\$100	300,000	\$30,000,000
<b>Total</b>			<b>\$87,000,000</b>

After converting that \$87 million into daily figure, we get \$238 thousand.

Our survey shows that 35% respondents choose A

Our survey shows that 4% respondents choose B

Our survey shows that 4% respondents choose C

Our survey shows that 57% respondents choose D

8. **Formulae – C**

$$p > 100 - t - s$$

Our survey shows that only 29% respondents choose C

Choice A, B, and D are incorrect because of the following reasons.

A)  $p = c$

You would pick this if you are unaware that all requests need to be called but not all of them can be successfully resolved.

Our survey shows that 14% respondents choose A

B)  $p = c - t - s$

You would pick this if you are unaware that some cases do require **both** technicians and sound engineer (when a technician is sent but unable to resolve the issue)

Our survey shows that 36% respondents choose B

D)  $p < 100 - t - s$

You would pick this if you are rushing just to get this question done. All 100% of the requests must be resolved (in other words,  $p + t + s$  cannot < 100).

Our survey shows that 21% respondents choose D

9. **Word Problems – C**

*52% of all requests*

There is more than one way to set up the equation for this question. As mentioned in our free materials online, you should set up your equation in the way that makes the most sense to you. The **unknown variable in the equation** ( $y$ ) is not necessarily the **variable asked in the question**.

Below is just an example of how I would set up the equation. Let  $y$  be the number of requests normally needed to be escalated to the *technician* level but now can be resolved with diagnostic calls right away in order to make the program break even.

## TOYO Piano

Cost of the program = Benefit of the program

Cost of the program = Benefit per year \* number of years

$$\begin{aligned} \text{Cost of the program} &= (\text{cost per technician case} * \# \text{ technician cases reduced}) * 2 \\ 10,000,000 &= (70 * y) * 2 \\ y &= \sim 70,000 \end{aligned}$$

From this, we can easily find that the new level of technician cases is 600,000 – 70,000 = 530,000, approximately 53% of all requests. C is the max value not exceeding 53%.

Our survey shows that only 36% respondents choose C

Common mistakes that lead to choice A, B, and D:

A) *45% of all requests*

Mis-setup equation: You would pick this if you are unaware that the question asks about the 2-year timeframe.

Our survey shows that 22% respondents choose A

B) *50% of all requests*

Mis-setup equation: You would pick this if you are unaware that every request needs a diagnostic call anyway.

Our survey shows that 14% respondents choose B

C) *60% of all requests*

Mis-calculation (or other miscellaneous mistakes)

Our survey shows that 28% respondents choose D

\* \* \*

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